Running Head: STOP CONSONANT CHARACTERISTICS

Stop Consonant Characteristics: VOT and Voicing in American-Born-Indonesian Children's Stop Consonants

A Senior Honor Thesis

Presented in Partial Fulfillment of the Requirements for Graduation

"with Honors Research Distinction in Speech and Hearing Science" in The Speech and Hearing Science Department of The Ohio State University

by:

Florence Lim Hardjono

The Ohio State University July 2011

Research Advisor: Robert A. Fox, Ph.D, Department of Speech and Hearing Science

For Jeremy, Sammy, and Gracie. My world changed for the better when you were born. Your language and cognitive development never cease to amaze me. May God allow me to carefully learn from you and other bilingual children throughout my academic journey. This is only the beginning.

Glory be to God the creator of language, who painted the sky and designed the amazing wonders of human beings.

Acknowledgments

I would like to thank my research advisor, Dr. Robert A. Fox, for his continuous guidance and support throughout this research project. Dr. Michelle S. Bourgeois, my academic honors advisor for her guidance and support throughout the writing process. Dr. Ewa Jacewicz, co-director of Speech Perception & Acoustics Laboratories for her support and guidance throughout the recording and data analysis process. Dr. John Grinstead, thank you for your willingness to be a part of the committee. Dr. Mary E. Beckman from the Ohio State University Linguistics Department for allowing me to assist Elizabeth A. McCullough (her doctoral student) in her bilingual VOT research. That initial exposure to research ignited my research interest in bilingual children language acquisition.

I am grateful and thankful for my subjects who took their time to participate in this project. In addition, I am indebted and grateful for my friends Helen Santoso, Maya Dewi, Natalie Gunawan, Irma Khouw, Ginger Wahjudi and Jean Johnson, who so willingly took care of my kids whenever I need to go to OSU campus.

Most importantly, I would not be able to complete this project without the loving support of my husband, Luki Hardjono. Thank you for holding of the battle at home and yes that includes all those "laundries" you washed and "meals" you microwaved.

This project was partially funded by an ASC scholarship, an SBS scholarship and Speech Perception & Acoustics Laboratories. My gratitude and thanks to the Ohio State University for its continuous support for research.

Finally, to my God who said, "For I know the plans I have for you," declares the LORD, "plans to prosper you and not to harm you, plans to give you hope and a future." Jeremiah 29:11.

Table of Contents

Abstract

The increasing number of Indonesian immigrants in the United States suggests the need for deeper understanding of English acquisition as a second language by Indonesian children and their adult caregivers. Unfortunately this language's interaction with English as an L2 (particularly in terms of language interference) is currently understudied. This study examines the acquisition of English stop consonants by typically developing Indonesian bilingual children and their parents. Thirteen pairs of parent-child Indonesian bilingual speakers produced six stop consonants (/p/, /t/, /k/, /b/, /d/ and /g/) common in both languages in word-initial position with a variety of vowels. Pictures representing these words were shown on a computer monitor and speakers were asked to say the word in the context "That's a ___" for English words and its equivalent "Itu ___" for Bahasa Indonesia words. The phonetic characteristics of voice onset time were the focus of this study. The prediction is that the children's production of English stops from both subject groups will have similar acoustical characteristics. However, their parents' production will have different acoustical characteristics because of the influence of the age of learning a second language. The findings of this study will enable us to learn more about first and second language acquisition among bilingual children.

List of Tables

List of Figures

Chapter 1: Introduction

The increasing number of bilingual children in the United States of America requires careful examination that looks into their language acquisition. The native language (L1) one learns in early childhood and a second language (L2) learned later in life often influence one another (Flege, 1991). Therefore, it is important for speech language pathologists to be aware of these differences in phonetic characteristic of bilingual children. Adequate knowledge about speech development in normal developing children from culturally and linguistically diverse background will enable speech language pathologists to work more effectively.

Currently, there are an increasing number of Indonesian immigrants in America. The majority of them settled and immigrated to the United States after finishing their college education. Indonesia is the fourth most populous country in the world and home to the largest Moslem population in the world (The World Factbook, 2009). Therefore, Bahasa Indonesia and its related dialect, Bahasa Malayu, is the most widely spoken language in Southeast Asia. Unfortunately, there is little phonetic research in the Indonesian language in general and even less in term of the acquisition of English by Indonesian children who were born in America. Many of these children grew up in a home environment in which both parents are Indonesian native speakers and late English learners. Therefore, these parents have distinct accent in their English pronunciation. One distinct pronunciation that can be seen is the pronunciation of stop consonants.

This study seeks to examine the phonetic characteristics of Indonesian children's stop consonants pronunciation as compared to their Indonesian parents and American English monolingual children. Specifically these three questions will be addressed.

1. What are the mean VOT values of Indonesian children and adults who participated in this study.
2. How and to what extent the VOT characteristics of English stop consonants production differ between children who have Indonesian parents and monolingual native American children.
3. What are the possible contributing or determinant factors that make their pronunciation differ.

Unfortunately, there is no previous study that examines the same questions. Therefore, this study will serve as a starting point in attempt to understand the pronunciation of word-initial English stop consonants by Indonesian children primarily by analyzing voice onset time (VOT) of (/p/, /t/, /k/, /b/, /d/, /g/) pronounced by Indonesian children ages 2-9 years old. The result of mean VOT values for those stop consonants in English will be compared to mean VOT values of the same stop consonants in Indonesian language in a later study.

Chapter 2: Literature Review

There are some basic differences in Bahasa Indonesia and English stop pronunciation. In Bahasa Indonesia, /p/, /t/, and /k/ are pronounced without a release of air (aspiration). On the contrary, in the "standard" American English those consonants are pronounced with aspiration. Therefore, it is predictable that aspiration in these voiceless English stops will present problems for Indonesian speakers who are learning English. Most likely, Indonesian speakers will say /p, t, k/ in English also without the expected aspiration.

There are also place of articulation differences for stops between the two languages. The stops /t/ and /d/ are dental sounds made with constriction between the tip of the tongue and the upper teeth in Bahasa Indonesia. However, English pronunciation of /t/ and /d/ is alveolar meaning the blade of the tongue is on the alveolar ridge (just behind the upper teeth) (Soderberg, 2008).

Stop consonants are the most common consonants in both pre-linguistic and early linguistic development regardless of a child's ambient language community (Kim & Gammon, 2010). In addition, more than 88% of languages use voicing to differentiate homorganic stops by exploiting three major timing relationships: lead voicing, long lag and short lag (MacLeod & Gammon, 2005). For the last five decades, VOT (voice onset time) has been used by researchers to measure the timing relationships that makes the distinctions among these three categories.

VOT

The important role of VOT to categorize stop consonants in a language was first proposed by Lisker and Abramson in 1964. VOT is defined as the temporal relation between the onset of glottal pulsing and the release of the initial stop consonant (Lisker & Abramson, 1964).

It is the length of time between the released of stop consonant to the start of voicing. VOT value can be negative when voicing start prior to consonant release. In order to measure the VOT value, the point of stop released and voicing must be determined.

In their study, Lisker and Abramson examined stop consonants data from 11 languages. They categorized stop consonants into 3 categories: lead, short lag and long lag. Those categories are differentiated by VOT values. Long lead is a category in which voicing start about 75-125 ms before the release of consonant (negative value VOT). Short lag is when voicing start 0-25 ms after the release. Long lag is when voicing start 60-100 ms after the release. (Lisker & Abramson, 1964).

Previous research has established that late learners are apt to produce English /p, t, k/ with VOT values that are too short for English (Flege, 1991). It would be interesting to see whether this condition would be true for Indonesian adult speakers in this study. In addition, it would be interesting to observe the possible differences that may occur.

Voicing

Another dimension that linguists use to distinguish stop consonant is "voicing." Voicing is defined as the vibration of vocal cords. Therefore there is a presence of vibration when voiced consonants are being produced and there is an absence of vibration when voiceless consonants are being produced.

Bahasa Indonesia has similar stop consonant voicing contrast to English. Both languages have voiced and voiceless stop consonants. However there are two phonetic differences between stops in English and in Bahasa Indonesia. First of all, voiced stops in English can occur in all environments such as root-initial, root-medial, and root-final position. Whereas voiced stops in

Bahasa Indonesia can only occur in root-initial and root-medial positions. Second, voiceless stops in Bahasa Indonesia [p,t,k] are unaspirated in root-initial position. However, these stops are pronounced with aspiration in English. In English, phoneticians argue that the voiced/voiceless distinction in initial position is actually an aspirated/unaspirated distinction.

(1) Example of stops in Bahasa Indonesia.

a. In root-initial position

Voiced stops		Voiceless Stops	
[**b**abi]	'pig'	[**p**ipi]	'cheek'
[**d**ada]	'chest'	[**t**ahu]	'tofu'
[**g**ajah]	'elephant'	[**k**amar]	'room'

b. In root-medial position

Voiced stops		Voiceless stops	
[sa**b**un]	'soap'	[pa**p**an]	'wooden platform'
[bi**d**an]	'midwife'	[hi**t**am]	'black'
[sa**g**u]	'sagoo'	[lu**k**a]	'laceration'

c. In root-final position

Voiced stops	Voiceless stops	
Do not exists.	[santa**p**]	'formal word for eat'
	[sika**t**]	'brush'
	[rasu**k**]	'possessed by demon'

Chapter 3: Methodology

Subjects

Thirteen Indonesian adults and seven American adults were recruited for this study. Seven children whose both parents are monolingual American English speakers and thirteen children whose both parents are Indonesian-English bilingual speakers. In addition, one child has an American monolingual mother and an Indonesian-English bilingual father. Data from this particular subject is not included in the analysis of mean VOT and mean closure duration. Therefore, there were 40 participants in this study. All participants live in Columbus, Ohio.

Table 1. Subjects' gender, birth country and home language preferences.

Subject	Gender	Birth Country	Home Language Preferences
Adult English Speaker	5 females, 2 males	America	7 English
Child English Speaker	4 females, 3 males	America	7 English
Adult Indonesian Speaker	9 female, 4 males	Indonesia	5 English, 6 Indonesia,2 half
Child Indonesian	5 females, 7 males	America, 1 born in Indonesia.	5 English, 4 Indonesia, 4 half
Child with American mother & Indonesian father	1 male	America	1 English

Indonesian children who were recorded are exposed to Bahasa Indonesia and Indonesian-accented-English at home through their bilingual parents. Parents of these children are native speakers of Bahasa Indonesia. The children's age ranged from two and a half to nine years old. American children who were recorded were exposed only to native-English-speakers at home. These children should not be exposed to other languages intensively by any other caregivers. The children's age ranged from three to eight years old. All of these children are typical developing children. The parents reported that none of the children have language delay, hearing problem, cognitive delay, or speech problem.

Table 2. Children's ages

Ages	Indonesian children	American children
Ages 2.5 years old	1	1
Ages 3 years old	0	1
Age 4 years old	2	3
Ages 5 years old	2	2
Ages 6 years old	0	0
Ages 7 years old	3	0
Ages 8 years old	1	3
ages 9 years old	1	0

All of the Indonesian adult participants came to America for college education (age 17-20), except for one adult male Indonesian who came to America when he was 7 years old. All of the American English speakers are educated middle class adults living in Columbus Ohio.

In addition to recording utterances containing stop consonant, Indonesian parent-child pairs were also recorded producing spontaneous speech. They were told to speak and interact in Bahasa Indonesia for 5 minutes. Each conversation was recorded directly into a computer's hard drive using Adobe Audition. This conversation was intended for future study and was not analyzed for this study.

All subjects were recruited personally by the principal investigator through her community involvement as well as emails and flyers. Any parent who identified his/her child as fitting the criteria was eligible to participate. Subjects were compensated $10 each for their participation.

Preliminary procedure.

Participants were escorted to Speech Perception and Acoustics Laboratories at The Ohio State University Speech and Hearing Science Department on the day of the recording. As soon as they were situated in the lab, the parent/caregiver was asked to complete a consent form and a permission form to participate in the study. The accompanied child was able to play or read book

in another room adjacent to the recording room while waiting for their parents. Upon completion of the consent forms, two background questionnaires (Appendix A for parent and Appendix B for child) were given to the parent to complete. It was necessary that the accompanying parent filled these questionnaires as accurately and with as much detail as possible.

The purpose of these forms was to enable the experimenter to obtain detail information about the child's background such as country of birth, age, school, as well as linguistic background such as home language preference. The information were useful in differentiating Indonesian children who have been exposed to more English-speaking environments such as school to those that have minimum exposure such as younger children who remain in the care of their Indonesian mother. The information was also useful in differentiating those who speak mainly English at home, mainly Indonesian, or mixed half and half between Indonesian and English.

Stimuli

The recording material consists of two sets of words (Appendix D and Appendix E). One set contains Indonesian words which cover all the English stop consonants (/p/, /t/, /k/, /b/, /d/, /g/) in initial position (Appendix D). Another set consists of English words that have similar stop consonants and vowel combination (Appendix E). The five vowels used in the stimuli were /a/, /e/, /i/, /o/, and /u/. In addition there were words such as "ladder, water, muddy, city" versus "putar, kadal, kotor, kuda" and "spesial, stasiun and skolah" versus "sky, spot, and stair". Therefore there were 37 words in each category. These additional words were not analyzed in this study. They were intended for future studies examining dental flaps in medial position in the two languages.

All of the stimuli were presented in an intervocalic environment. The English stop consonant stimuli were presented in a sentence preceded by "That's a" (i.e. "That's a book"). The Indonesian stop consonant stimuli were presented in a sentence preceded by "itu" (i.e "Itu buku"). In intervocalic positions, speakers sustain the vibration of the vocal folds longer so that the low-frequency periodic energy lasts for an extended period of time of stop closure duration (Jacewicz, Fox, Lyle, 2009).

A picture of each stimuli appeared on the screen and participants named the pictures by reading the sentence below the picture. The picture was easy enough to identify even though the child was not able to read the sentence. In the case of young children who were unable to read, the experimenter gave explicit instructions and few examples that demonstrated "that's a" must precede the word that the picture represented.

Figure 1. Sample of an English stimulus.
This figure illustrates one of the English stimuli in the study.

Data collection / Recording

Participants were recorded in a sound attenuating booth in the Speech Perception and Acoustics Laboratories in the Department of Speech and Hearing Science at the Ohio State University. The participants were seated facing a computer screen inside the booth. A microphone on a stand was located on the table between the computer and the participant. Some

of the younger children sat in front of the computer with their caregiver and the experimenter. Participants were allowed to take as many breaks as they liked. Participants were asked to plan to be in the lab for two hours for the recording sessions.

During the recording session, the experimenter would click on the record button on the computer screen after the participant said each sentence. If a child was unable to name the word presented on the screen, the parent would said the sentence first. The children were told to repeat the sentence after the parent finished. In this case of prompted response, the response was recorded as "prompt response." There was a special button image on the computer that the experimenter would be able to click to record the prompted response.

The participants were asked to record six practice words (Appendix C) in each category for a total of twelve words before recording the words from each language. The first language that the Indonesian speakers were asked to do is Bahasa Indonesia. Each subject was asked to go through each word list twice. There were thirty seven pictures in the list of Bahasa Indonesia stimuli (Appendix D). The same procedure was executed with the English picture set (Appendix E) after they were done with the Indonesian picture set. American English monolingual speakers were asked to record only the English picture set twice. Recording was done using a special Matlab program that displayed the pictures and recorded the utterances directly to a hard drive.

Data analysis

The recordings were analyzed using spectrographic analysis (utilizing Adobe Audition and TF32 software program). The starting point of stop closure and stop release during each stop were carefully measured and recorded. The duration between the starting point of stop closure and the released point were calculated as closure duration. VOT was the duration measured from

the point of closure released to the start of voicing. This acoustic measurement is illustrated in figure 2.

Figure 2. Markers for calculating VOT and closure duration (the word: baby).

Then, voicing is carefully examined and recorded. Voicing during the stop was classified into four categories in this study. Voicing code 0 indicates lack of voicing during the entire closure duration. Voicing code 1 is assigned when voicing started prior to closure release. Voicing code 2 is assigned when there was voicing throughout the entire closure duration. Voicing code 3 is assigned when there is partial voicing in the initial part of closure duration but stopped before closure released. The voicing code categories can be seen in figures 3-6

The first category of voicing is called voiceless and not pre-voiced in which no voicing occurs during closure duration (voicing code 0) as shown in figure 3.

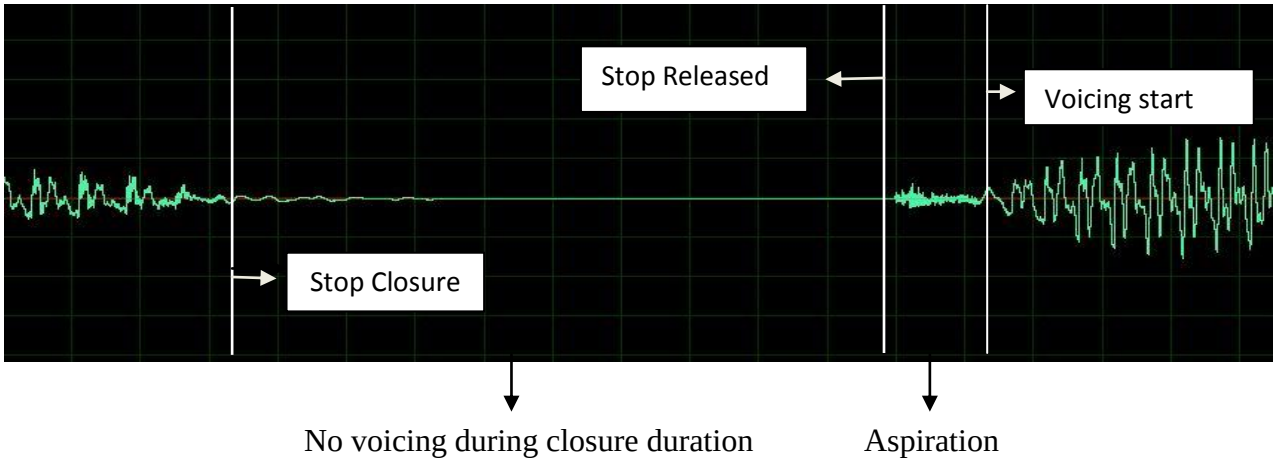


Figure 3. An example of no voicing on a spectrogram (the word: tub).

The second type of voicing is called pre-voicing (voicing code 1). Pre-voicing occurs when voicing is evident before the stop released. The pre-voicing category is shown in figure 4.

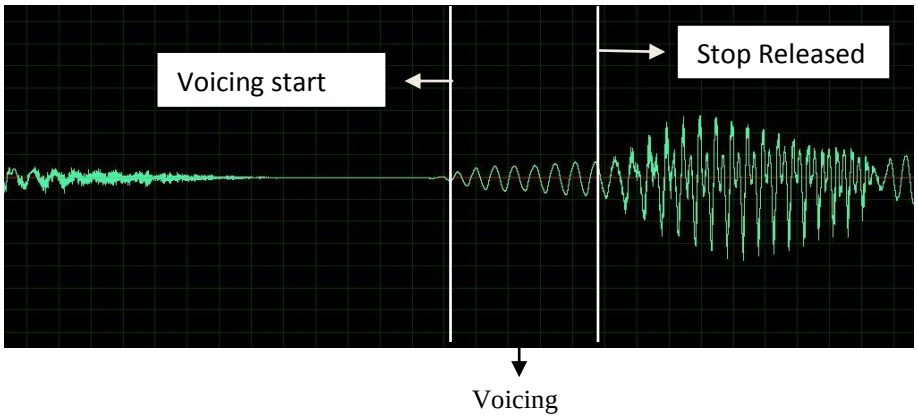


Figure 4. An example of pre-voicing on a spectrogram (the word: doddle).

The third type of voicing (voicing code 2) is a complete voicing in which voicing occurs throughout the entire closure duration, shown in figure 5.

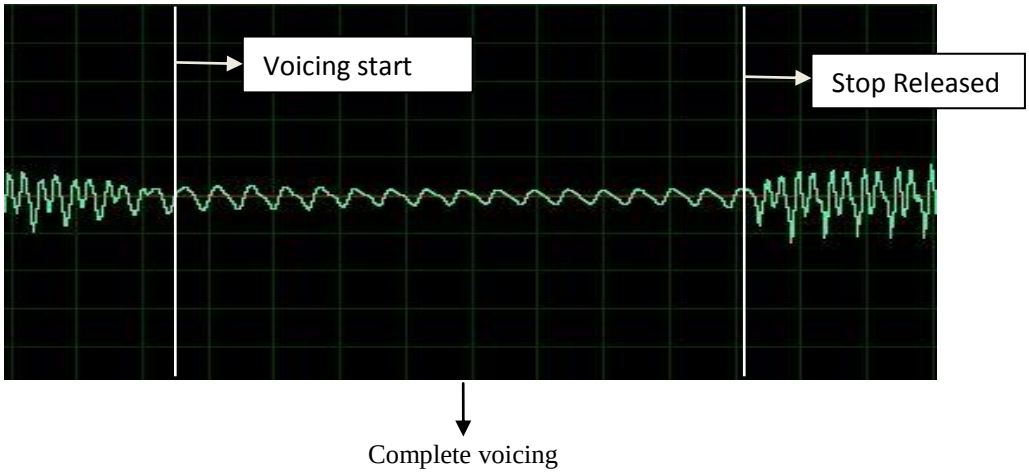


Figure 5. An example of complete voicing on a spectrogram (the word: baby).

The last type of voicing is partial voicing in which voicing occurs only in the initial part of closure duration (voicing code 3) often caused by longer closer duration as shown in figure 6.

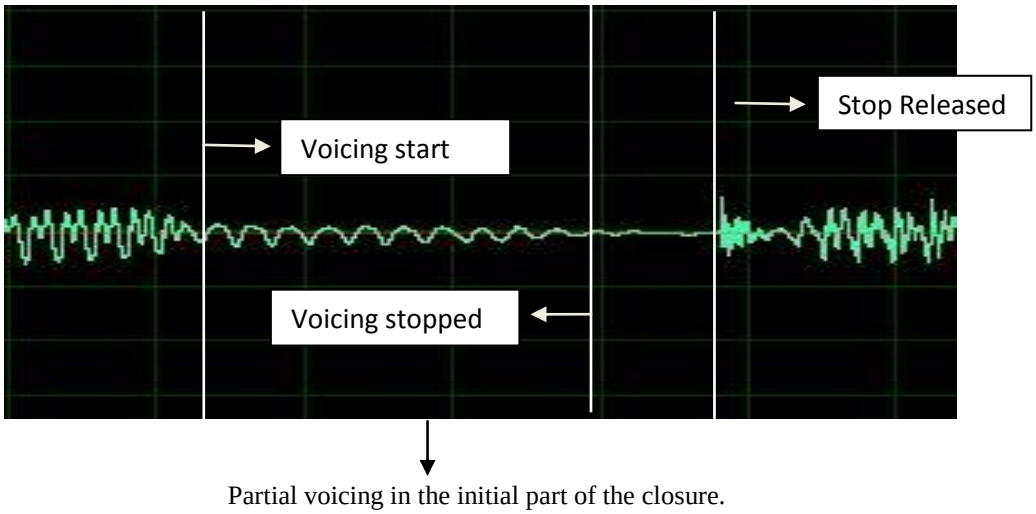


Figure 6. An example of partial voicing on a spectrogram (the word: duck).

The locations of stop closure, closure release, the start of voicing and voicing code were measured and the measurements were entered into an Excel file. These recorded time allow us calculate a closure duration and VOT. All measurements were converted to ms.

Closure duration: (closure released time – stop closure time)*1000 ms

VOT: (Time of voicing after closure released-closure released)*1000ms.

Finally, all the data were analyzed using SPSS software.

Chapter 4: Result

Voicing

As cited by Jacewicz, Fox & Lyle, 2009, there is evidence from developmental studies that young children's voiced stops are often devoiced and have less closure voicing than adults (Kewley-Port & Preston 1974). This is evident in the result shown in table 3. In addition, a stop occurring in the intervocalic position should naturally be voiced throughout most if not all of the closure if it is short. In the case of a longer closure the stop will be voiced though the initial portion of the closure and then become voiceless (Jacewicz, Fox & Lyle, 2009). Indonesian adult and children participants have longer closure duration and therefore they have higher number of stops that are initially voiced.

Table 3. Result of voicing categories across speakers.

Stop Voicing	Speakers	Voicing Code				Total
		0	1	2	3	
VOICELESS						
	Adult English	70 (67%)	0 (0%)	0 (0%)	35 (33%)	105 (100%)
	Child English	67 (56%)	1 (.85%)	2 (1.7%)	48 (41 %)	118 (100%)
	Adult Indonesian	155 (79.5%)	1 (.5%)	0 (0%)	39 (20%)	195 (100%)
	Child Indonesian	140 (80%)	2 (1%)	0 (0%)	33 (19%)	175 (100%)
	TOTAL	**432 (73%)**	**4 (.67%)**	**2 (.33%)**	**155 (26 %)**	**593 (100%)**
VOICED						
	Adult English	4 (4%)	0 (0%)	75 (71%)	26 (25%)	105 (100%)
	Child English	22 (19%)	0 (0%)	35 (30%)	61 (51%)	118 (100%)
	Adult Indonesian	28 (14.50%)	1 (.51%)	101 (52%)	63 (33%)	193 (100%)
	Child Indonesian	53 (30%)	2 (1%)	42 (24%)	79 (45%)	176 (100%)
	TOTAL	**107 (17.5%)**	**3 (.5%)**	**253 (43%)**	**229 (39%)**	**592 (100%)**

It can be seen in the table that adult Indonesian speakers and child Indonesian speakers have more voiced stops that are partially voiced in the beginning of the closure duration. Adult Indonesian speakers have 63% partially voiced consonants and child Indonesian speakers have 79% partially voiced consonants. This was caused by the fact that adult Indonesian speakers and child Indonesian speaker have longer closure duration. In addition child English speakers also have higher percentage of partially voiced consonants of 61% compare to adult English speakers who only have 26%. Child English speakers have considerably longer closure duration than adult English speakers.

Mean VOT and closure duration across speaker types.

There are no significant differences across VOT values for all speaker types in their voiced and voiceless stop consonants pronunciation as shown in table 4 and represented in the graph in figure 7. However, both Indonesian adult and child speakers have longer closure duration compared to English monolingual speakers as shown in table 5 and represented in figure 8.

Table 4. Mean VOT across speaker types.

Spk_type	stop_voicing	Mean	N	Std. Deviation
Adult English	Voiceless	53.8	105	16.7
	Voiced	17.4	30	9.6
	Total	45.7	135	21.6
Child English	Voiceless	72.8	101	29.5
	Voiced	24.0	83	17.4
	Total	50.8	184	34.7
Adult Indonesian	Voiceless	43.3	195	19.2
	Voiced	20.9	92	9.9
	Total	36	287	19.8
Child Indonesian	Voiceless	71.5	175	35.9
	Voiced	24	134	18.9
	Total	51	309	37.9
Total	Voiceless	59	576	29.8
	Voiced	22.6	339	15.9
	Total	45.5	915	31

This result suggested that the L1 English learners (Indonesian children who were born in America) developed a phonetic system for stop consonants that are similar to American English monolingual children. On the contrary, Indonesian adults who were born in Indonesia and were exposed to English consistently as adults (L2 English learners) have different phonetic characteristics.

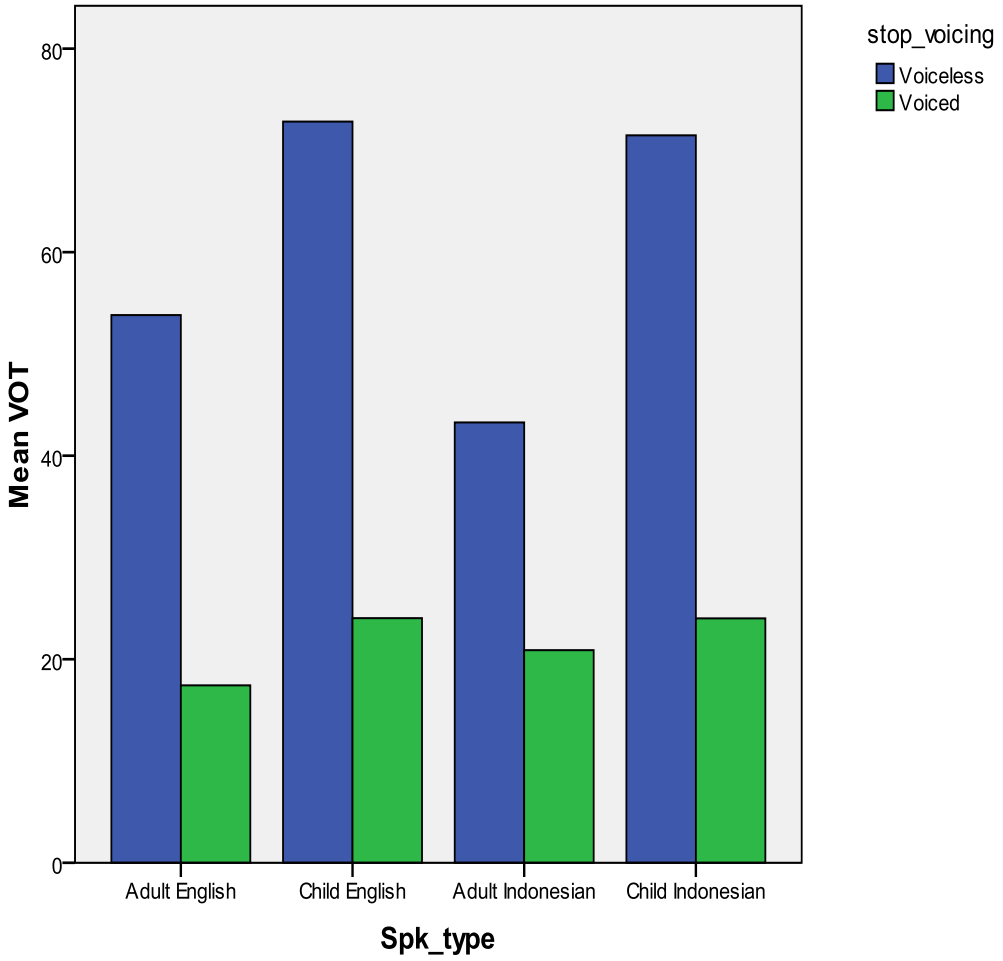


Figure 7. Mean VOT across speaker types.
This figure compares mean VOT values for voiced and voiceless stops across speaker types.

In the meantime, closure duration is considerably longer across Indonesian adult and child speakers as compared to English adult and child speakers as shown in table 5.

Table 5.Closure duration across speaker types for voiced and voiceless stops.

Spk_type	stop_voicing	Mean	N	Std. Deviation
Adult English	Voiceless	70.4	105	15.2
	Voiced	72.5	105	17.8
	Total	71.4	210	16.6
Child English	Voiceless	99.4	104	41.0
	Voiced	111.3	103	37.6
	Total	105.3	207	39.7
Adult Indonesian	Voiceless	105.3	195	29.2
	Voiced	99.6	193	26.6
	Total	102.5	388	28.0
Child Indonesian	Voiceless	126.8	175	46.3
	Voiced	131.8	176	63
	Total	129.3	351	55.3
Total	Voiceless	104.4	579	40.5
	Voiced	106.6	577	46.6
	Total	105.5	1156	43.7

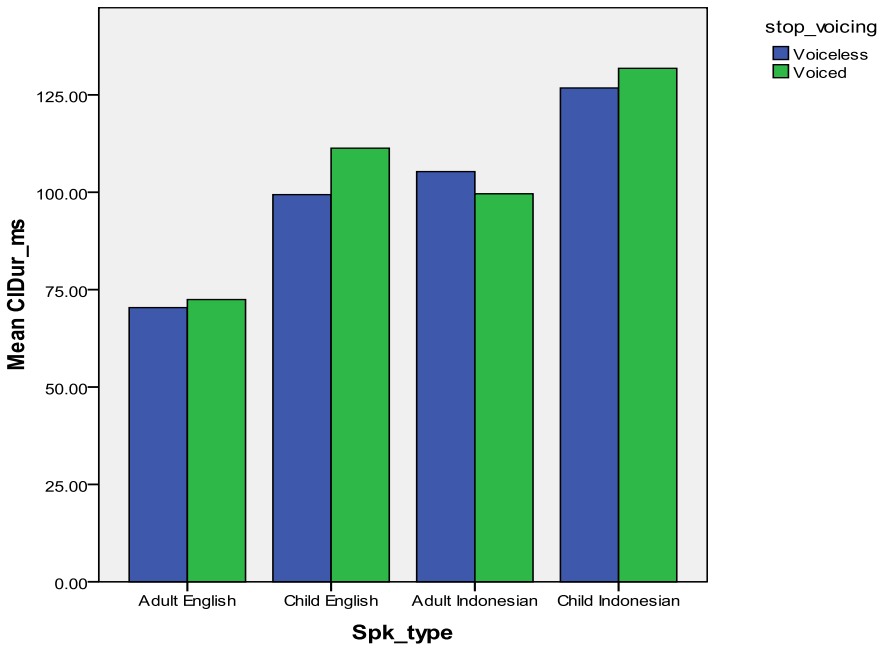


Figure 8. Mean closure duration across speaker types.
This figure compares mean closure duration values for voiced and voiceless stops across speaker types.

Mean VOT for Indonesian adults based on home language preference.

The data shown previously showed that mean VOT for English adult speakers is 17.4 ms for voiced stop consonants and 53.8 ms for voiceless stops. Table 6 shows voiced and voiceless mean VOT for Indonesian adult speakers based on their home language preferences.

Table 6. Mean VOT based on home language preferences for Indonesian adults.

	Indonesian	Half and Half	English
Voiced	20.8	24.2	19.2
Voiceless	43.3	40.8	44.5

It is interesting to see that Indonesian adults who speak English at home have closer mean VOT value to English monolingual adult speakers compare those who speak Bahasa Indonesia at home. Moreover, Indonesian adult speakers who speak half English and half Bahasa Indonesia at home have the biggest value differences to the mean VOT value of English monolingual adult speakers. This is an interesting fact to explore in further detail because the higher value differences could be caused by language interference between L1 and L2.

Mean closure duration for Indonesian adults based on home language preferences.

In addition, English adult speakers' mean closure duration for voiced consonant was 72.5 ms and for voiceless consonant was 70.4 ms. Mean closure duration for Indonesian adult speakers were considerably longer than those of English monolingual adult speakers as shown in table 7.

Table 7. Mean closure duration based on home language preferences for Indonesian adults.

	Indonesian	Half and Half	English
Voiced	99.5	90.5	104.3
Voiceless	99.6	113.2	111.3

Mean VOT for Indonesian children based on home language preference.

Mean VOT value for English monolingual children was 24 ms for voiced consonant and 72.8 ms for voiceless consonant. Table 8 shows mean VOT value for Indonesian children based on their home language preferences.

Table 8. Mean VOT based on home language preferences for voiced and voiceless stop consonant for Indonesian children.

	Indonesian	**Half and Half**	**English**
Voiced	32.9	17.4	25.7
Voiceless	50	73.7	93.9

It is interesting to see that VOT values for children who prefer to speak English at home is similar to VOT value of English monolinguals children's in voiced consonants. On the other hand, it is surprising to see that VOT values for voiceless consonants produced by Indonesian children who speak half English and half Indonesian at home is similar to VOT value of monolingual child English speakers. It was expected that those who prefer to speak Indonesian at home will have similar VOT values with Indonesian adult speakers who also prefer to speak Indonesian at home.

Mean closure duration for Indonesian children based on home language preferences.

Mean closure duration for Indonesian children are considerably higher across Indonesian and English home language preferences as compared to English children speakers. Nevertheless, the mean closure duration of Indonesian children who speak half and half is similar closure duration value with English monolingual speakers and Indonesian adults who also speak half and half.

Table 9. Mean closure duration based on home language preferences for voiced and voiceless stop consonants for Indonesian children.

	Indonesian	**Half and Half**	**English**
Voiced	144.3	112.6	148.6
Voiceless	148.4	118.5	114.2

Chapter 5: Discussion.

The Indonesian adult speakers might have different phonetic characteristics in their production of stops because they had passed a critical period for learning the language that would make them fluent as native speakers. Lenneberg, said "that a foreign accent in an L2 is "inevitable" if it is learned after puberty because brain development and lateralization for language function have reached completion by that time. (Lenneberg, 1967).

It was mentioned earlier in the introduction that Indonesian voiceless stop consonants in initial position are not aspirated, contrary to voiceless aspirated English stop consonants in initial position. Therefore, it was predicted that Indonesian adult speakers who are late English learners will have difficulty pronouncing the aspirated stops in initial position. This prediction is supported by the VOT findings in voiceless stop consonants as shown in figure 9.

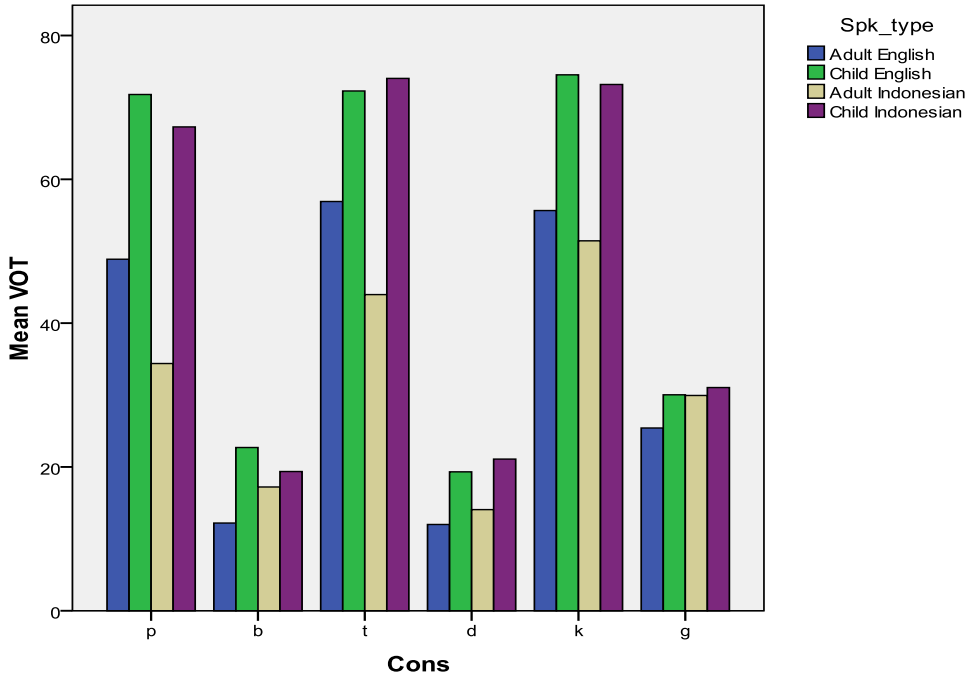


Figure 9. Mean VOT for each consonant across speaker types.
This figure compares mean VOT values for each consonant across speaker types.

Figure 9 shows that (/p/,/t/,/k/) in the Indonesian adult speakers has shorter VOT compared to the American adult speakers. However, Indonesian children VOT in (/p/ and/k/) are not much different than the American monolingual English children. In fact, the mean VOT for /t/ is higher in Indonesian children than in English children for reason yet to be investigated.

The differences between early English learners (Indonesian children born in America) and late English learners (Indonesian adult parents) VOT values can also be explained using the speech learning model (SLM). The Speech Learning Model was first described by Flege in 1988. The SLM posits that speech production is organized at phonemic category, phonetic category, and sensory-motor levels (Flege, 1991). Therefore, after the phonetic categories have been established for L1 sounds in early childhood, listeners are increasingly likely to identify L2 sounds that are partially resemble corresponding sounds in the L1 as being realizations of an L1 category (Flege, 1991).

Therefore in this case, Indonesian adults as late English learners will continue to pronounce similar sounds (stops in English and Bahasa Indonesia) with minimal distinctions. Nevertheless, Indonesian children who were born in American and had been exposed to English earlier in life will eventually able to differentiate the acoustic phonetic differences for stops in English and in Bahasa Indonesia.

With regard to home language preferences, very few studies have specifically examined this condition. One of the studies was conducted by Goldstein, Fabiano and Washington in 2005. The result of their study indicated that there were no significant correlations between amount of output in each language and phonological skill (Goldstein, Fabiano & Washington, 2005). The result of this study showed slight differences in mean values between

speakers based on home language preferences. However, the values may not be significant enough to support a hypothesis that home language preferences can be a contributing factor in determining the phonetic contrast between English and Bahasa Indonesia spoken by Indonesian children.

Limitation in this study is that there is no known data available regarding Indonesian adult or children phonetic characteristic of stops that this study can compare its result with.

Chapter 6: Summary/Conclusion

In general, documenting bilingual children's phonetic development is a very difficult and challenging task. It is important to remember that the result of this study might be influenced by important factors such as rate of phonetic context, age of children, and stress position. In addition, there is very little data available on Indonesian children phonetic acquisition of English in particular and of Bahasa Indonesia in general to compare the result of this study.

Therefore, this study serves as a pilot study on American-born-Indonesian-children's language acquisition research. At this point, it would be too early to draw a solid conclusion on how Indonesian children acquire English phonetic system. Therefore, further study is crucial to learn more extensively on how these two languages interact in Indonesian children who were born in America.

Nevertheless, the result of this study support the critical period hypothesis that said adult learners of an L2 will not be able to develop "native" like ability in pronunciation compare to early learners of the L2. The VOT differences between Indonesian adult speakers and Indonesian children speakers reflected the evidence for the critical period hypothesis because Indonesian children speakers have similar VOT values as their English children monolingual speakers.

As of the case of voicing and closure duration, further research need to be done to compare the closure duration value. Therefore, it is imperative that this study should be follow by another study that will examine Indonesian monolingual adult speakers and Indonesian monolingual children speakers. These future research participants should not be exposed to English language extensively for more than 6 months.

References

Central Intelligence Agency. (2009). CIA The World Factbook: 2009. Retrieved April 8th, 2010, from https://www.cia.gov/library/publications/the-world-factbook/geos/id.html

Baker, W., Trofimovich, P., Flege, J. E., Mack, M., & Halter, R. (2008). Child-Adult Differences in Second-Language Phonological Learning: The Role of Cross Language Similarity. *Language & Speech, 51, 317-342.*

Barton, D., & Macken, M. A. (1980). An Instrumental Analysis of the Voicing Contrast in Word-Initial Stops in the Speech of Four-Year-Old English-Speaking Children. *Language and Speech, 23,* 2, 159-69

Barlow, J. (2007). Grandfather Effects: A Longitudinal Case Study of the Phonological Acquisition of Intervocalic Consonants in English. *Language Acquisition,14,* 2, 121-164

Deuchar, M., & Clark, A. (1996). Early Bilingual Acquisition of the Voicing Contrast in English and Spanish.*Journal of Phonetics*, *24,* 3, 351-65

Edwards, J., & Beckman, M. E. (2008). Methodological questions in studying consonant acquisition. *Clinical Linguistics & Phonetics, 22,* 12, 937-956

Fabiano-Smith, L., & Goldstein, B. A. (2010). Phonological Acquisition in Bilingual Spanish-English Speaking Children. *Journal of Speech, Language & Hearing Research, 53, 160-178.*

Flege, J. E. (1991). Age of Learning Affects the Authenticity of Voice-Onset Time (VOT) in Stop Consonants Produced in a Second Language. *Journal of the Acoustical Society of America, 89,* 1, 395-411.

Gandour, J., Petty, S. H., Dardarananda, R., Dechongkit, S., & Mukngoen, S. (1986). The Acquisition of the Voicing Contrast in Thai: A Study of Voice Onset Time in Word-Initial Stop Consonants. *Journal of Child Language, 13,* 3, 561-572

Goldstein, B. A., Fabiano, L., & Washington, P. S. (2005). Phonological Skills in Predominantly English-Speaking, Predominantly Spanish-Speaking, and Spanish-English Bilingual Children. *Language, Speech & Hearing Services in Schools, 36, 201-218.*

Jacewicz, E., Fox, R. A., & Lyle, S. (2009). Variation in stop consonant voicing in two regional varieties of American English. *Journal of the International Phonetic Association, 39, 313-334.*

Johnson, C. E., & Wilson, I. L. (2002). Phonetic Evidence for Early Language Differentiation: Research Issues and Some Preliminary Data. *International Journal of Bilingualism, 6,* 3, 271-89

Kim, M., & Stoel-Gammon, C. (2011). Phonological Development of Word-Initial Korean Obstruents in Young Korean Children. *Journal of Child Language, 38,* 2, 316-340.

Lenneberg, E. H. (1967). *Biological foundations of language*. New York: Wiley.

Lisker, L., & Abramson, A. (1964). A Cross-Language Study of Voicing in Initial Stops: Acoustical Measurements,"Word 20: 384-423.

Macken, M. A., & Barton, D. (1980). The Acquisition of the Voicing Contrast in Spanish: A Phonetic and Phonological Study of Word-Initial Stop Consonants.*Journal of Child Language, 7,* 433-58

Macken, M. A., & Barton, D. (1980). The Acquisition of the Voicing Contrast in English: A Study of the Voice Onset Time in Word-Initial Stop Consonants.*Journal of*

Child Language, 7, 41-74

MacLeod, A., & Stoel-Gammon, C. (2005). Are bilinguals different? What VOT tells us about simultaneous bilinguals. *Journal of Multilingual Communication Disorders, 3,* 2, 118-127.

McLaughlin, M. L. (1984). *Conversation: How talk is organized*. Beverly Hills: Sage Publications.

Pena, E. D., Bedore, L. M., & Zlatic-Giunta, R. (2002). Category-Generation Performance of Bilingual Children: The Influence of Condition, Category, and Language. *Journal of Speech, Language & Hearing Research, 45,938-947.*

Ryalls, J., Cliche, A., Fortier-Blanc, J., & Coulombe, I. (1997). Voice-onset time in younger and older French-speaking Canadians. *Clinical Linguistics & Phonetics, 11,* 3, 205-212.

Simon, E. (2010). Child L2 development: A longitudinal case study on Voice Onset Times in word-initial stops. *Journal of Child Language, 37,* 1, 159-173.

Soderberg, C. D., & Olson, K. S. (2008). Illustrations of the IPA: Indonesian. *Journal of the International Phonetic Association, 38,* 2, 209-213.

U.S. Census Bureau. (2008). Yearbook of Immigration Statistic: 2008. Retrieved April 1st, 2010, from http://www.dhs.gov/xlibrary/assets/statistics/yearbook/2008/ois_yb_2008.pdf

Walker, R. (2001). Pronunciation for International Intelligibility. Retrieved April 5th, 2010, from http://www3.telus.net/linguisticsissues/internationalintelligibility.html

Yeni-Komshian, G. H., Flege, J. E., & Liu, S. (2000). Pronunciation Proficiency in the First and Second Languages of Korean-English Bilinguals. *Bilingualism: Language and Cognition, 3,* 2, 131-49

`

Appendix A: Parent Background Questionnaire.

LANGUAGE BACKGROUND QUESTIONNAIRE (ADULT)

1. Date of birth _____ Current age _____

2. Sex MALE FEMALE

3. Where have you lived, and what age were you at the time (starting with place of birth)?

Place (city, area, country)	*Ages (from __ to __)*
_____	_____
_____	_____
_____	_____
_____	_____

4. Where were your parents or other caretakers born? Where did they grow up? What languages do/did they speak?

Relation	*Place of birth*	*Place(s) they grew up*	*Language(s) spoken*
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

5. What language(s) did your parents or other caretakers speak to you at home when you were growing up?

_____

6. What do you consider to be your native language(s)? _____

7. Including your native language(s), what languages do you know? At what age did you begin learning each language? How well can you write, read, speak, and understand each language?
(1) BARELY / NOT AT ALL (2) POORLY (3) PASSABLY (4) FLUENTLY

Language	*Age*	*Writing*	*Reading*	*Speaking*	*Understanding*
_____	___	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
_____	___	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
_____	___	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
_____	___	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4

8. For each language you mentioned in the question above, please estimate the percentage of your current language use that takes place in each language.

Language	*% of current language use*
_____	_____
_____	_____
_____	_____

9. Do you interact with speakers of English from other parts of the world (India, Great Britain, Indonesia, Singapore, etc.)? YES NO
If you circled *yes*, please describe who, how often, and where each speaker is from.

_____

_____

10. Do you interact with speakers of foreign-accented English? YES NO
If you circled *yes*, please describe who, how often, and each speaker's native language(s).

_____

11. Circle the highest level of education you have completed so far.

PRIMARY JUNIOR HIGH HIGH SCHOOL COLLEGE POST-GRADUATE

12. What is your profession? (If academic or student, please indicate field of study.)

_____

13. Do you have any speech, language, or hearing disorders? YES NO
If you circled *yes*, please provide details.

_____

_____

Appendix B: Child Background Questionnaire

LANGUAGE BACKGROUND QUESTIONNAIRE (CHILD)

1. Child's date of birth _____ Child's current age _____

2. Child's sex MALE FEMALE

3. Where has your child lived, and what age was s/he at the time (starting with place of birth)?

Place (city, area, country)	*Ages (from __ to __)*
_____	_____
_____	_____
_____	_____
_____	_____

4. What language(s) does your child hear and spoken at home?

_____

5. If your child hears more than one language at home, please estimate the percentage of time s/he hears each language, relative to the other language(s).

Language	*% of current language experience*
_____	_____
_____	_____
_____	_____
_____	_____

6. What do you consider to be your child's native language(s)? _____

7. Does your child interact with speakers of English from other parts of the world (India, Great Britain, Indonesia, Singapore, etc.)? YES NO
If you circled *yes*, please describe who, how often, and where each speaker is from.

_____

_____

8. Does your child interact with speakers of foreign-accented English? YES NO
If you circled *yes*, please describe who, how often, and each speaker's native language(s).

_____

_____

9. Does your child attend daycare/preschool/kindergarten? YES NO
If you circled *yes*, please indicate how many hours per week your child attends each of the following:

In-home care (relative, friend, neighbor, etc.) _____

Commercial daycare center/preschool program _____

Elementary school kindergarten class _____

If you circled *yes*, please indicate what language your child's daycare providers or teachers speak when interacting with your child.

_____

10. Does your child have any speech, language, or hearing disorders? YES NO
If you circled *yes*, please provide details.

Appendix C: Practice Stimuli


That's a baseball


That's a cape


That's a car


That's a dog


That's a key


That's a pool


Itu bakmi


Itu gelas

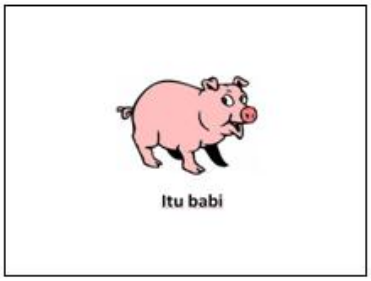

Itu topi

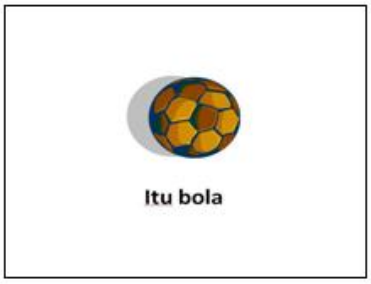
Itu piring

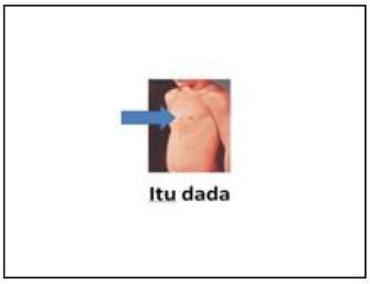
Itu tas

Itu kompor

Appendix D: Bahasa Indonesia stimuli







Itu duduk

Itu gajah

Itu gelap

Itu gigi

Itu gol

Itu gula

Itu kadal

Itu kamar

Itu kentut

Itu kilat

Itu kuda

Itu kupu-kupu

Itu paku

Itu pesta

Itu pipi

Itu pohon

Itu puser

Itu tahu

Itu tomat

Itu tidur

Itu tutup pintu

Itu teko

Itu kotor

Itu putar-putar

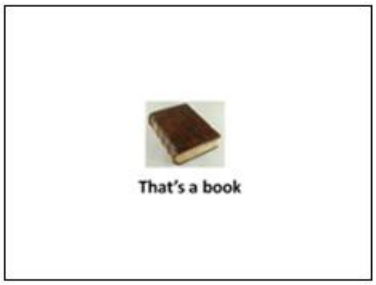
Itu kodok

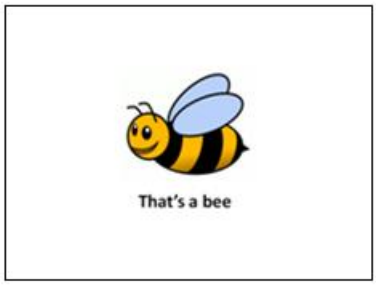
Itu stasiun

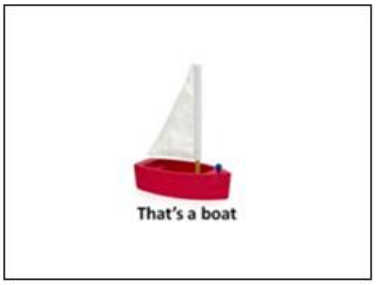
Itu skolah

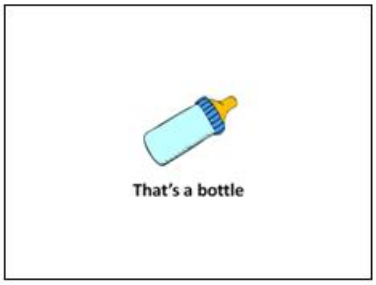
Itu spatu

Appendix E: English Stimuli









That's a kitchen

That's a deer

That's a desk

That's a donut

That's a doddlebops

That's a duck

That's a geese

That's a girl

That's a goat

That's a goose

That's a gun

That's a pencil

That's a Pig

That's a pony

That's a poodle

That's a Puddle

That's a table

That's a tea cup

That's a toe

That's a toothbrush

That's a tub

That's a ladder

That's a water-hose

That's a muddy boot

That's a city

That's a sky

That's a spot


That's a stair